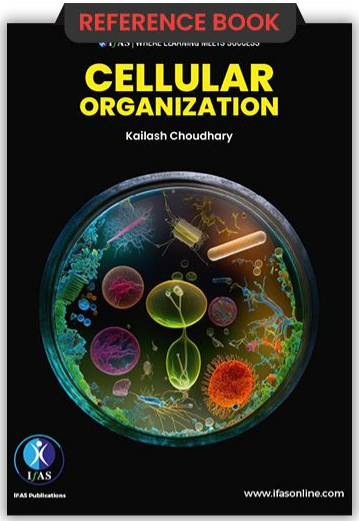
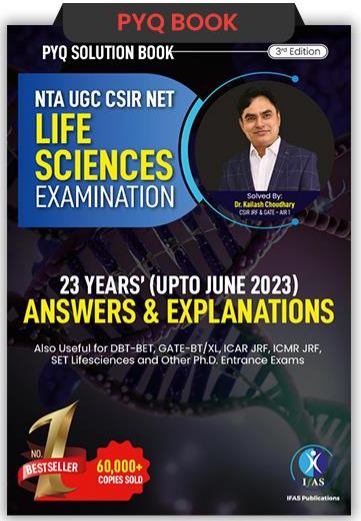
Don't wait for the opportunity. Create it.

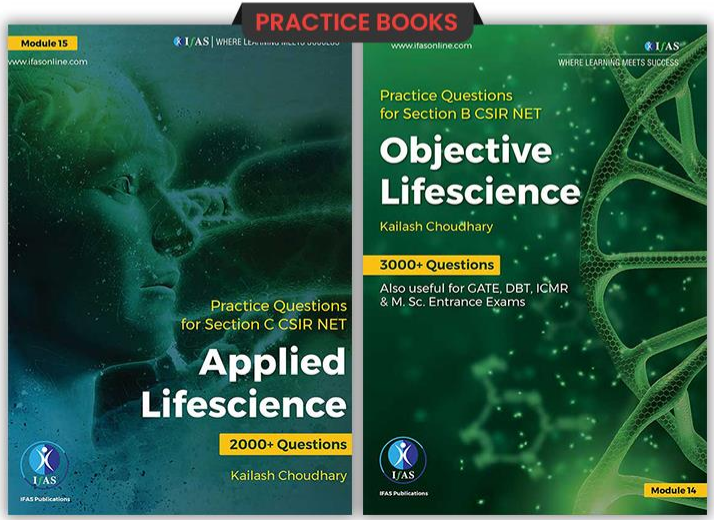
CSIR NET – Life Science

Unit 2: Cellular Organization

L1 INTRODUCTION TO CELL




PYQ BOOK
PYQ SOLUTION BOOK
3rd Edition
NTA UGC CSIR NET
LIFE SCIENCES
EXAMINATION
Solved By: Dr. Kailash Choudhary
23 YEARS' (UPTO JUNE 2023)
ANSWERS & EXPLANATIONS
Also Useful for DBT-BET, GATE-BT/XL, ICAR JRF, ICMR JRF, SET Lifesciences and Other Ph.D. Entrance Exams
NO 1 BESTSELLER
60,000+ COPIES SOLD



IfAS

Order Online and Get Free Delivery Across India

Points to be covered in this Lecture

- What is Cell?
- Cell Theory
- Three Domains of Life
- Prokaryotic Cell and Eukaryotic Cell
- Animal Cell and Plant Cell
- Plasma membrane

What is Cell ?

→ Enclosed boundary

→ Biological cell → Functional and fundamental unit of life

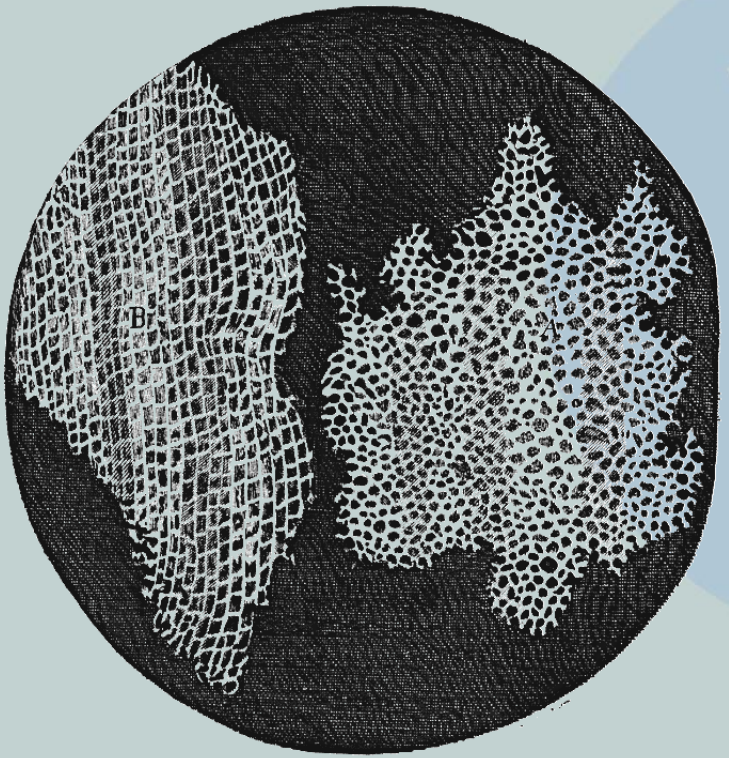
* anything less than cell can not perform independent function

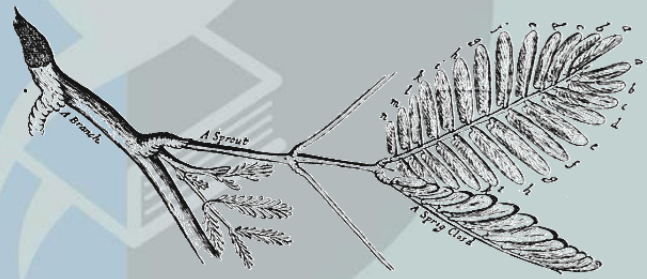
eg - Virus

Protein + DNA

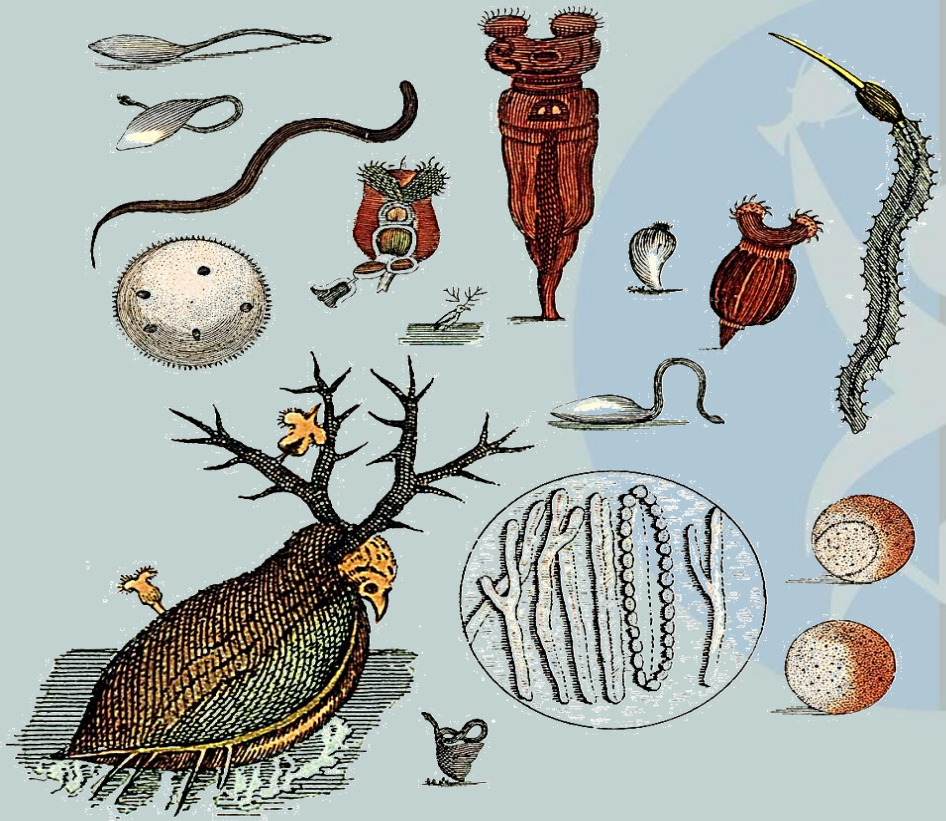
The cell was first seen by **Robert Hooke** in 1665

Book **Micrographia**





Anton van Leeuwenhoek (1673) : Animalcules



⇒ 1833 - Robert brown - Discovered Nucleus in Plant cell

Protoplasm discovered (living matter)

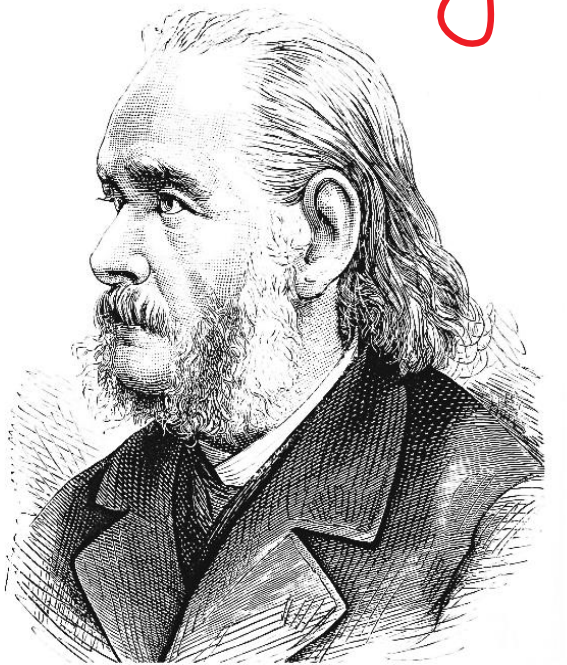
1838 → matthias Schleiden (Botanist)

"all Plants are made up of cell"

Schwann → all animals are composed of cell

Cell Theory (1839) → all plants and Animals are made up of cells

Theodor Schwann (1810–1882)



Matthias Jakob Schleiden (1804–1881)

1. All living organisms are composed of one or more cells

2. The cell is the most basic structural and functional unit of life

3. All cells arise only from pre-existing cells **(Rudolf Virchow, 1855)**

Modern interpretation of Cell Theory

* Cell is Structural, functional, Reproductive, Genetical & fundamental unit of life.

→ any thing less than cell can not perform independent function

Exception to Cell Theory

- Virus
- Viroid - Naked circular ss RNA virus
- virusoids - circular ss RNA (for its replicabion it required helper virus)
- Prion → Protein
- Coenocytic Algae
- Mature RBC
- phloem Sieve tube

Barley yellow dwarf virus:
Helper virus-luteo virus.

Basics of Cell

Cell Theory (proposed by Matthias Schleiden, Theodor Schwann)

- All living organisms are composed of one or more cells
- The cell is the most basic structural and functional unit of life
- All cells arise only from pre-existing cells (Rudolf Virchow, 1855)

Exception to Cell Theory: Virus, Viroid, Virusoids, Prions, Aseptate Fungus

Cells can be divided into 2 major types: Prokaryotic and Eukaryotic cell

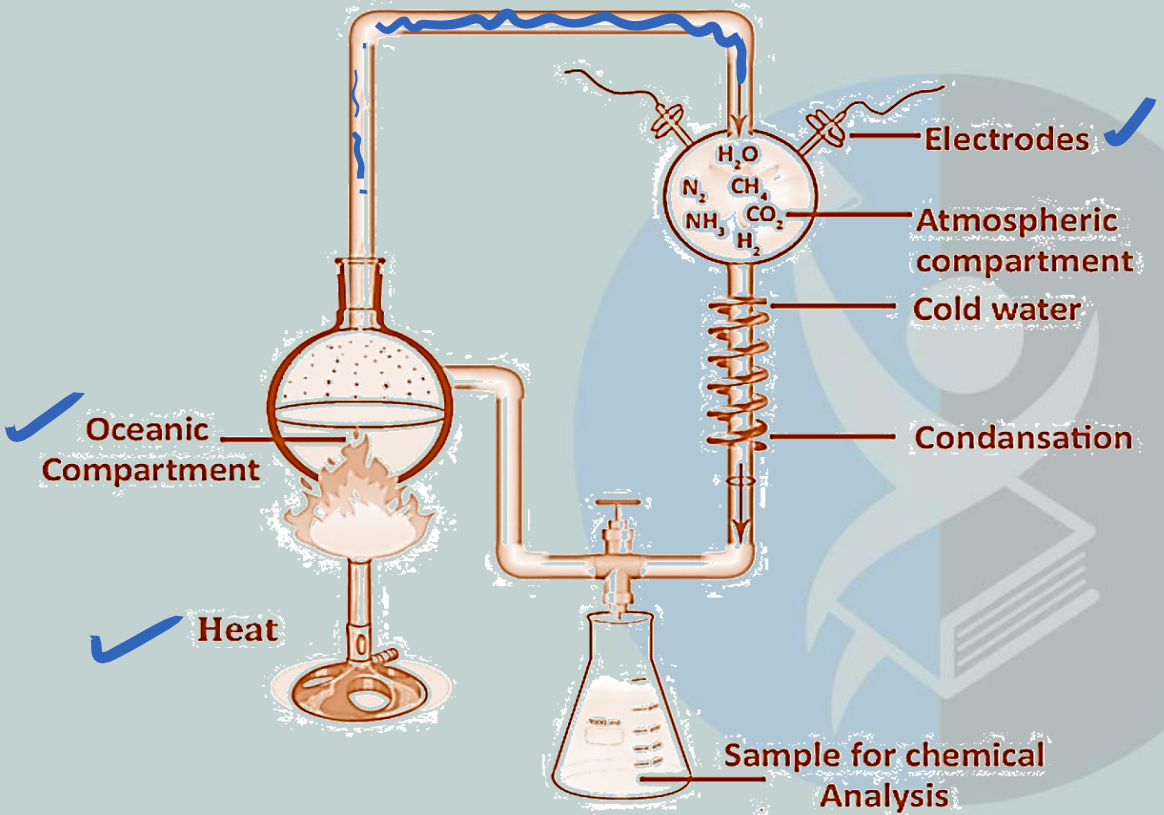
Origin of First Cell

↓

Coeservates → organic rich fluid

Evolutionary Steps (A. I. Oparin and J.B.S. Haldane in 1920s**)**

(1) Synthesis of organic molecules



Miller and Urey experimental apparatus Synthesis of organic polymers

~~H_2O~~
CH_4
CO_2
H_2
N_2

(2) Origin of self-replicating molecule such as RNA

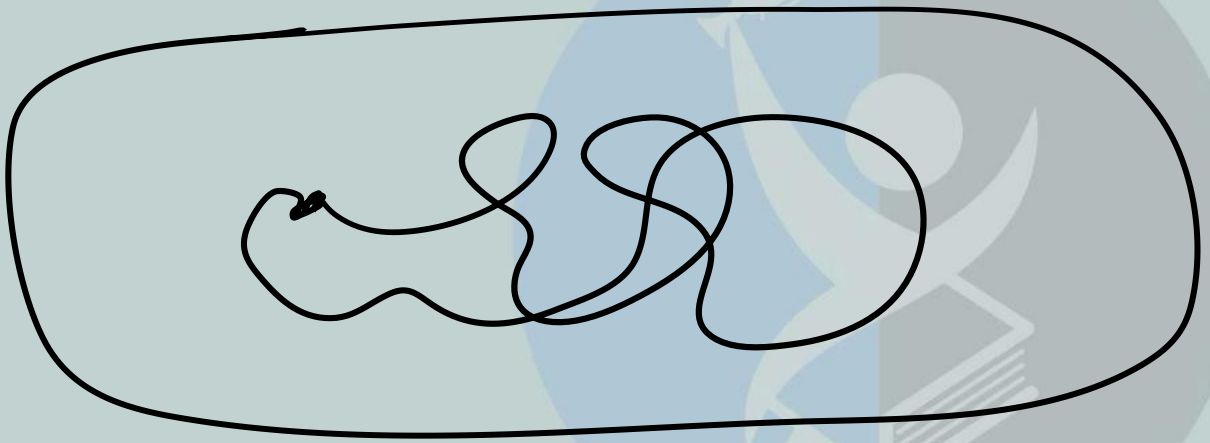
↓

RNA world → Primitive world

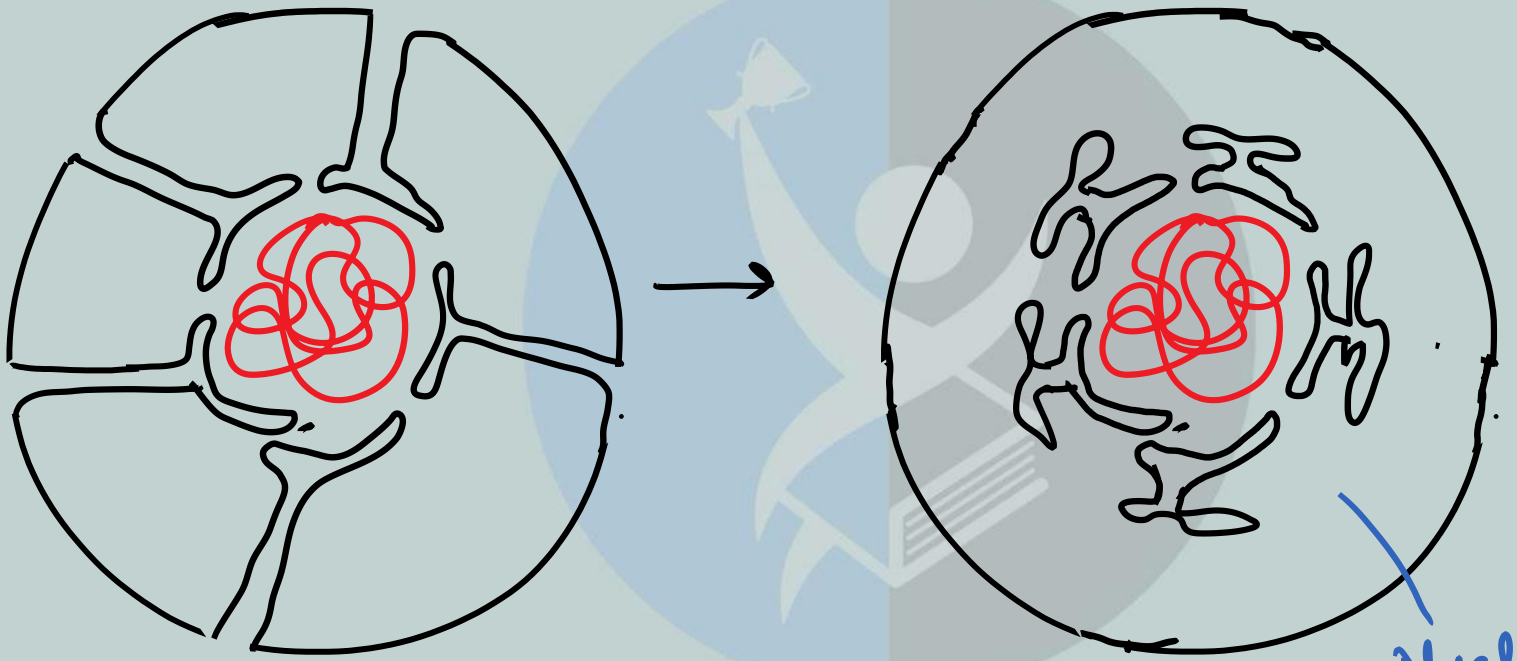
Encapsulation by organic molecule
↓
(lipid)

(3) Natural selection of suitable RNA/DNA,

(4) Evolution of first prokaryotic cell

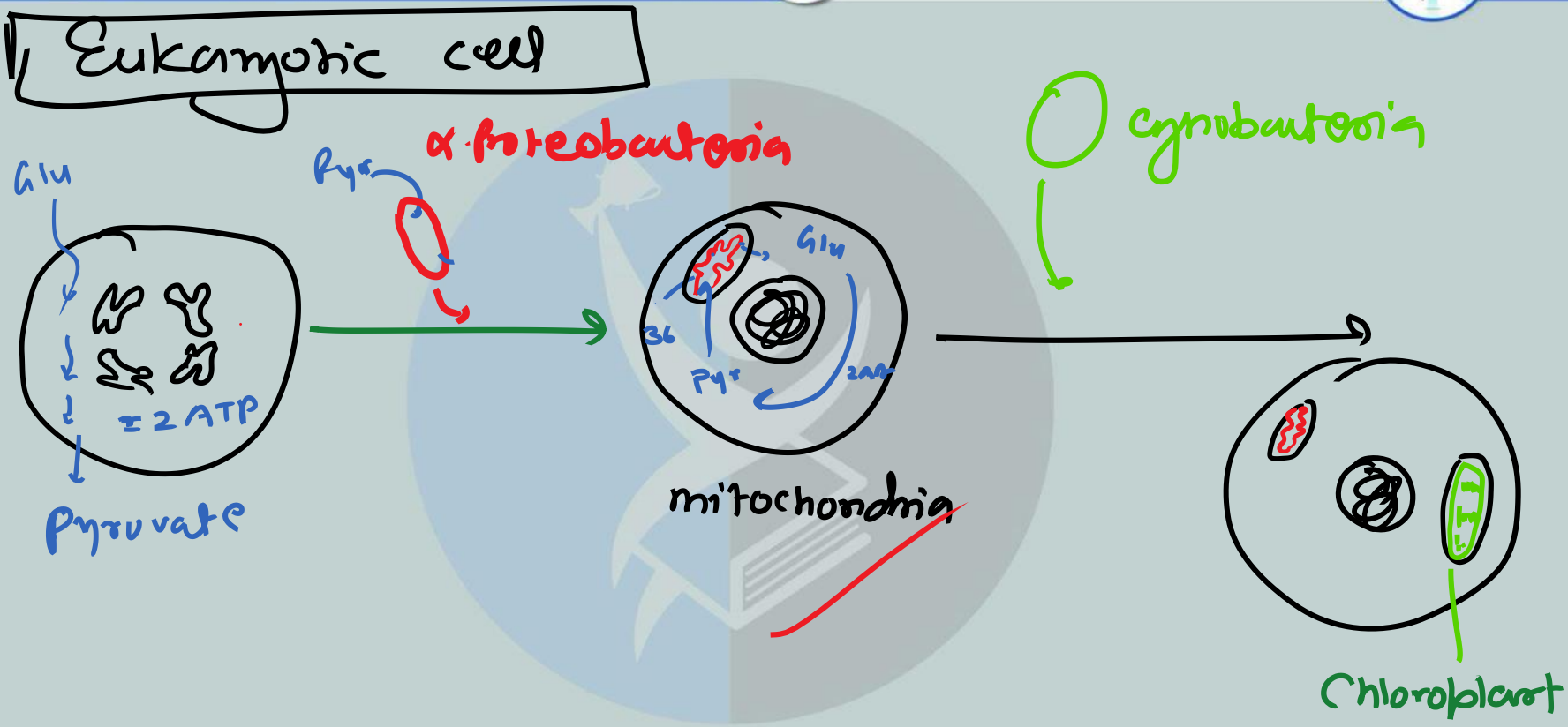


(5) Evolution of first eukaryotic cell



(6) Evolution of multi-cellular eukaryotes

due to Compartmentalization (in Eukaryotic cell)

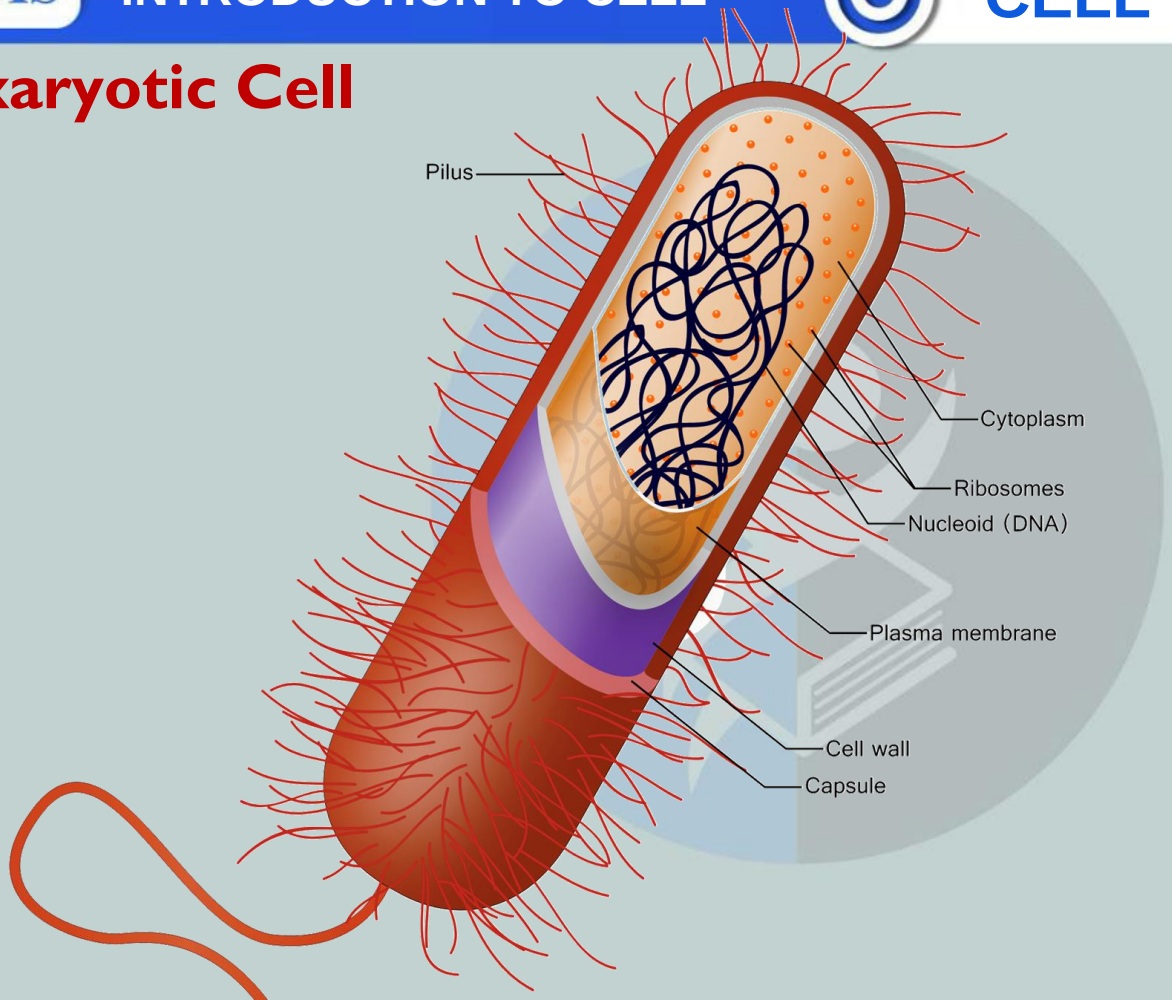

Eukaryotic cell
Glu
Pyr
α-proteobacteria
cyanobacteria
= 2 ATP
Pyruvate
Glu
3C
Pyr
2AP
mitochondria
Chloroplast

Evolution of Metabolism

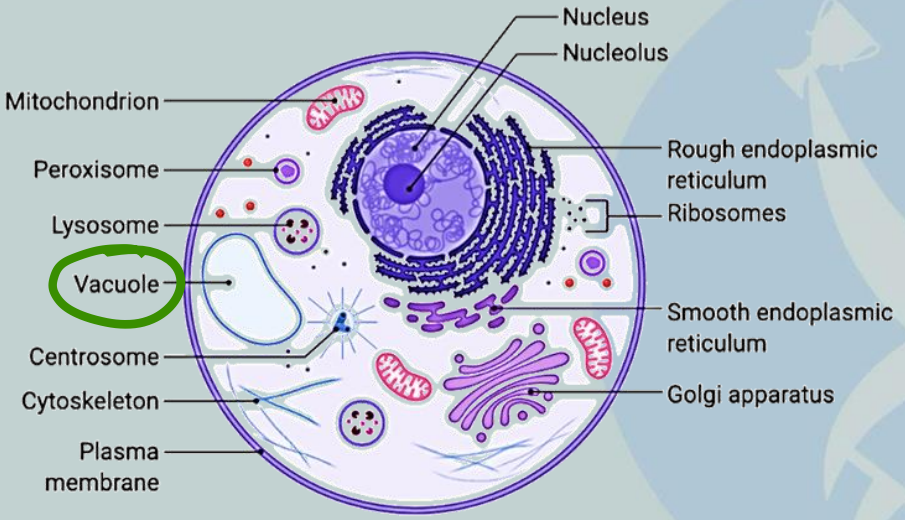
1. Glycolysis →
2. Photosynthesis
3. ETC

Classification of cells (**Hans Ris** in the 1960's)

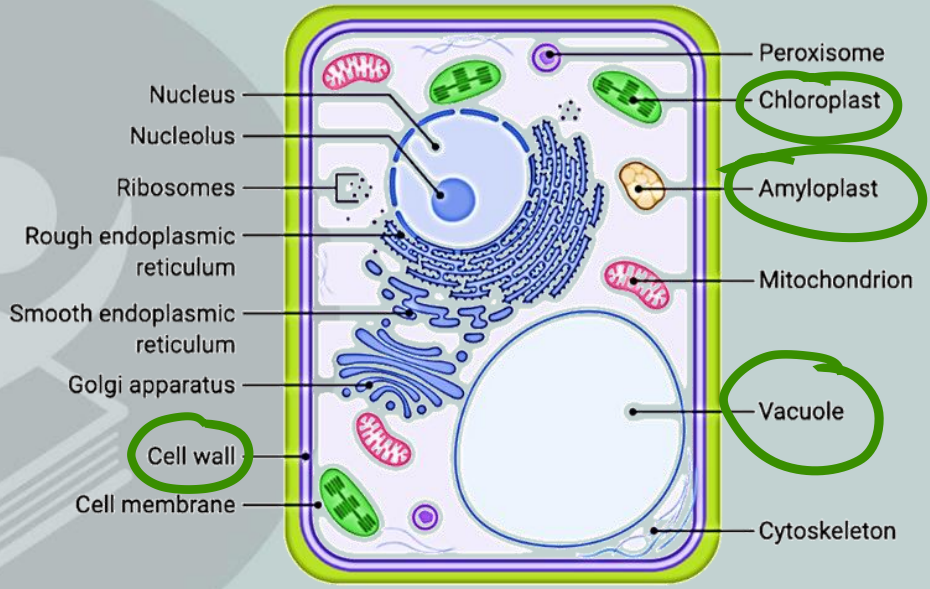
Prokaryotic Cell



Eukaryotic Cell



Animal Cell



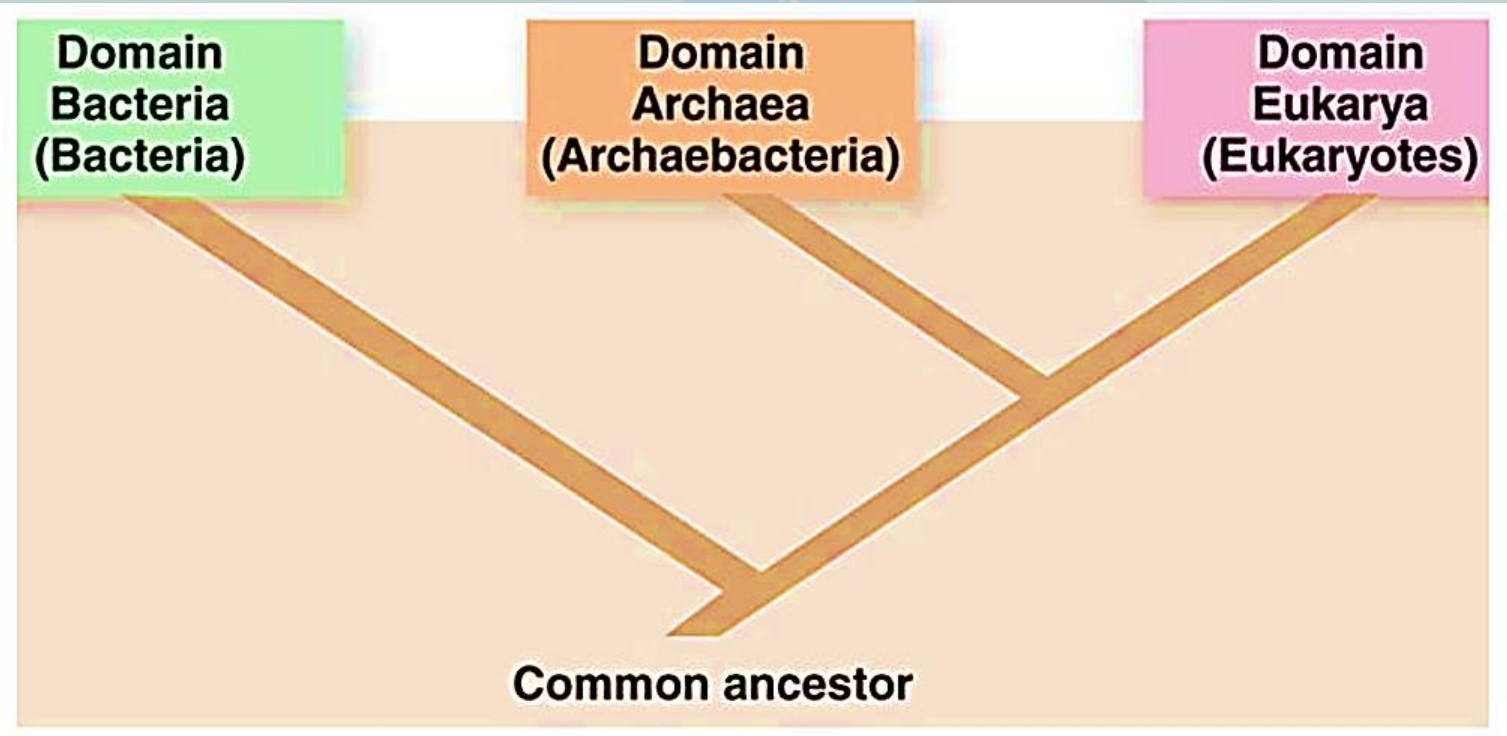
Plant Cell

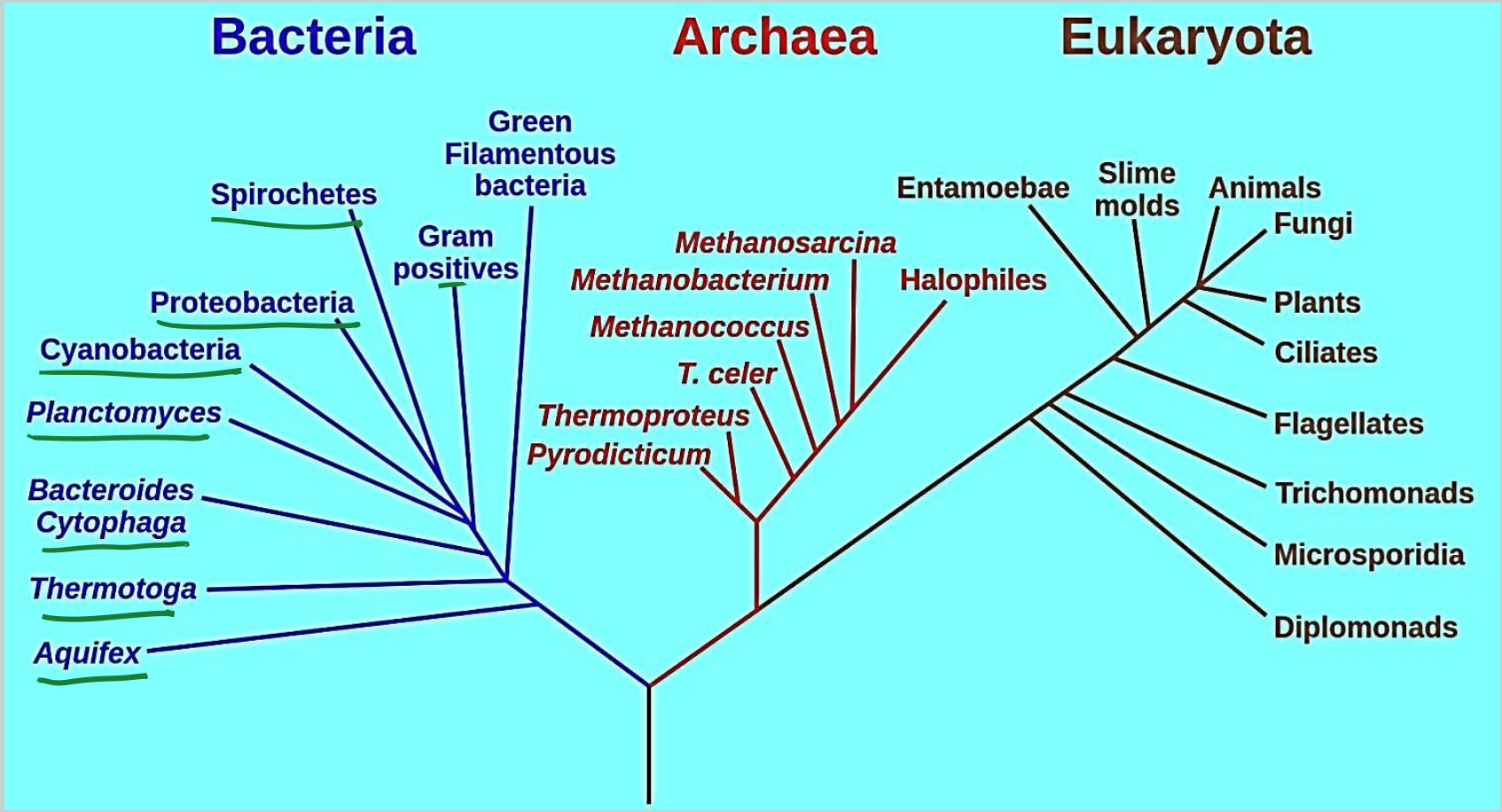
	Prokaryotes	Eukaryotes
Type of Cell	Unicellular	Unicellular, Multicellular
Cell size (diameter)	0.2-2.0 uM	10-100 uM
Cell wall	+nt (Exception-myco*)	only -nt in animal cell
Nucleus	-nt	+nt
Ribosomes	✓	✓
DNA arrangement	Nucleoid	Highly organized->
Compartmentalization	x	✓
Mitochondria	x	✓
Endoplasmic reticulum	x	✓
Plasmids	✓	✓
Lysosome	x	✓
Cell division	✓	✓
Flagella	✓	✓
Cytoskeleton	x	✓
Reproduction	✓	✓

Characteristic	Plant Cell	Animal Cell
Cell wall	Present, composed of cellulose	Absent
Centrioles	Absent	Present
Plastids	Present, such as chloroplasts	Absent
Vacuoles	One large central vacuole is present, which occupies most of the cell's volume	Small and multiple vesicular vacuoles
Cytoplasmic streaming	Present	Absent
Cytokinesis	Cell plate forms during cytokinesis	Cleavage furrow forms during cytokinesis
Mitochondria	Numerous, with cristae that are flat, disc-shaped	Fewer in number, with cristae that are tubular or finger-like
Lysosomes	Rarely found	Commonly found
Flagella	Absent	Present in some cells, for example sperm
Extracellular matrix	Absent, Cell wall present	Present, in the form of collagen, elastin, and glycoproteins

Three Domains of life (16S rRNA)

Carl Woese (1977)




Bacteria
Archaea
Eukaryota
Green Filamentous bacteria
Spirochetes
Gram positives
Proteobacteria
Cyanobacteria
Planctomyces
Bacteroides Cytophaga
Thermotoga
Aquifex
Methanosarcina
Methanobacterium
Methanococcus
T. celer
Thermoproteus
Pyrodicticum
Halophiles
Entamoebae
Slime molds
Animals
Fungi
Plants
Ciliates
Flagellates
Trichomonads
Microsporidia
Diplomonads

Characteristic	Archaea	Eubacteria
Cell wall	Often lack peptidoglycan, have pseudo-peptidoglycan or S-layer	Have peptidoglycan
Membrane lipids	Have ether-linked phospholipids with branched side chains	Have ester-linked phospholipids with unbranched side chains
Introns	May have introns in their genes	Rarely have introns in their genes
RNA polymerase	Have multiple types of RNA polymerases with different subunits	Have a single type of RNA polymerase
Histones	Have histone like proteins that bind DNA	Lack histone proteins
Extreme environments	Many can survive in extreme environments, such as high temperatures, high salinity, or high acidity	Few can survive in such extreme environments
Phylogeny	Share common ancestry with eukaryote	Do not share direct ancestry with

www.ifasonline.com

thank you

Learn From India's Best Educators

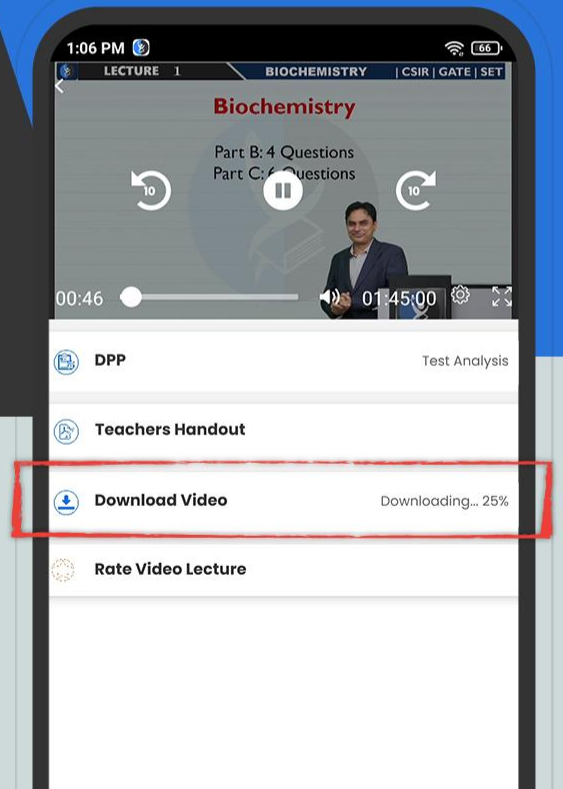
India's **No.1** EdTech Company for Graduates
& Post Graduates Examination.

Download **IFAS** App Now

ANDROID IOS WINDOWS

SAVE YOUR INTERNET DATA USAGE!

Minimize Internet Usage by Downloading Lectures from the IFAS App & Access them Offline



IfAS

Harshada Sharma

Earned: ₹25,500

"As is widely recognized, IFAS stands as India's leading institute for CSIR NET examination preparation. My Personal philosophy has always revolved around helping others and I've had the pleasure of introducing the IFAS Online Course to 12 of my classmates and juniors, which in turn allowed me to earn 25,500 rupees. You too can join in and refer your friends, allowing you to earn a 5% rewards based on the fees each of your referred friends Pay"

REFER & EARN

Step – 01 Invite Friends

Share your referral code or Link with your friends.

Step – 02 Earn Cashback

On Every Purchase made using your referral code, you earn 5% instant cashback in your bank account.

Step – 03 Refer More, Earn More

Keep referring as many friends as you can and keep **Earning** cash as much as you can

Friendship is Sharing, Caring, Giving & Helping Each Other...!